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AUTHOR Honey, Margaret; McMillan, Katherine
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ABSTRACT

The kinds of representations and associations that elementary and secondary educators are building of the Internet and the ways in which these representations vary depending on their use were studied. Subjects were teachers from the Center for Technology in Education (New York) national telecommunications survey who had responded that they used the Internet for more than just electronic mail. Participants were sent an open-ended questionnaire that covered Internet use, involvement, learning, use in schools, future, and background. Responses were received from nine women and nine men who had spent an average of 19 years working as educators. Half were classroom teachers, two were librarians, and the others were technology specialists at classroom or administrative levels. All but two of the interviews were conducted over the Internet. Responses indicate that obstacles to Internet use for elementary and secondary education are substantial. These users were extremely technologically sophisticated and were drawing on skills they had developed outside their professional roles as teachers. They also were in schools with the necessary technology--conditions not available for the majority of teachers. Suggestions are given for making the Internet more accessible and more friendly for the educator user, as well as for expanding the available technology. (Contains 26 references.) (SLD)

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Case Studies of K-12 Educators Use of the Internet: Exploring the Relationship Between Metaphor and Practice

Margaret Honey & Katherine McMillan
Center for Children and Technology
Education Development Center

> To appreciate what the Internet has to offer, imagine discovering a whole system of highways and high-speed connectors that cut hours off your commuting time...This is a new dimension - an electronic, virtual world where time and space have almost no meaning. (From Tracy LaQuey, Internet Companion)
>
> The Internet is like an ocean. It is huge...No one owns it...It is filled with valuable resources. You could swim freely...Find wonderful islands...Become stranded...or get eaten by sharks! ! ! Fortunately, you can rescue yourself with Internet navigation tools. (From the Merit Cruise of the Internet)

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Introduction

The Internet is in the midst of a growth spurt, and the makeup of the community of Internet users is fundamentally changing (LaQuey & Ryder, 1992). The Internet is expanding from its roots as the almost exclusive domain of research scientists, technology development researchers, hackers, and international academics into serving as a resource for a far broader range of people, including students, educators, activists -- potentially, just about everyone.

Making the Internet a viable resource for the K-12 community is particularly important, because it offers access to a wealth of resources that chronically have been in short supply for K-12 educators. Increasingly, the Internet is being used to overcome a number of obstacles that beset the working lives of teachers. Teachers' working days are structured and highly scheduled, leaving little or no time for non-teaching or non-administrative tasks, and few if any opportunities to attend meetings or classes on a regular

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basis. In addition, teachers have limited opportunities to interact in an ongoing collaborative fashion with their colleagues in other schools, whose different experiences and perspectives can add valuable new dimensions to problem-solving. Telecommunication tools can provide teachers with access to a wealth of information, ranging from scientific studies to reports on educational research to curriculum resources and activities (Katz, McSwiney & Stroud, 1987; Katz, Inghilleri, McSwiney, Sayers, & Stroud, 1989; Ruopp, Gal, Drayton & Pfister, 1993; Watts, 1992).. The proliferation of education-related newsgroups and listserves are demonstrating the technology's potential for building and sustaining professional development communities for educators.

In addition, there is wide-spread agreement that telecommunications tools can enhance the range and scope of what students learn in the classroom (Brienne and Goldman, 1988; Cohen and Reil, 1986; Levin and Cohen, 1985; Newman, et. al, 1988; Reil, 1985; Reil and Levin, 1990; Ruopp, 1993). With the aid of creative teachers, students are using a range of telecommunications environments to gather and exchange scientific data, to carry out creative writing projects, and to exchange cultural and social information (Foster, Julyan and Mokros, 1988; Honey & Henriquez, 1993; Riel, 1987; Rogers, 1992). In the last five years, the use of telecommunications in the classroom has moved beyond the research and development phase and become a wide-spread component of numerous technology integration efforts. Providing educators with access to the Internet is currently being discussed as an essential component of the educational reform agenda (Hunter, 1992; Lavin & Phillepo, 1990, NII, 1993).

Despite its promise widespread use of the Internet has not yet become a reality for the vast majority of K-12 educators. Results of a national survey of

K-12 educators use of telecommunications for student learning and professional development, suggest that even among a technologically sophisticated group of practitioners, Internet access was limited and use of tools, other than electronic mail, was rare. This research aroused our curiosity about those few educators who were actively using the Internet. In particular, we were interested in exploring two issues: the range of circumstances in which educators are using the Internet, and the ways in which these different environments influence and shape their interpretations of the Internet as a resource for K-12 education.

As the quotes at the opening of this paper demonstrate very different images and representations of the Internet exist. The Internet as "superhighway" -- by far the most commonly used metaphor -- calls forth a trail of associations. Superhighways imply fast, efficient, travel; well mapped roadways that are easy to enter and exit; and many thousands of individuals effortlessly zipping from one point to another. In contrast, the Internet is sometimes described as an ocean. Oceans call forth a very different set of associations: exploration, discovery, murkiness, mystery, uncharted territory, and perhaps the threat of drowning. As the network of networks, the Internet does not lend itself to literal representation, it *is* abstract, complex, and hard to pin down. Consequently, metaphors play an important role in structuring our relationship to and experience of the Internet, and influence the ways in which we are invited to engage with its resources.

In this research we investigate the kinds of representations and associations that educators are building of the Internet and the ways in which these representations vary depending upon the circumstances of use. We set out to explore how such factors as prior experience with technology and teaching, availability of training and/or collegial support, administrative

commitment, as well as the type of Internet connection and the availability of navigation tools might effect educators experiences and attitudes toward the viability of the Internet as a K-12 resource.

Developing the Sample

We contacted a subset of those respondents from the CTE national telecommunications survey who reported that they used the Internet for more than just electronic mail. Because we were interested in examining a range of practices and circumstances of Internet use we contacted classroom teachers, technology specialists, and district coordinators/supervisors, who represented different grade levels in different geographic regions. Educators were contacted electronically, over the Internet, as well as through the CTE newsletter and the Cleveland FreeNet. All responses were voluntary.

This study is based on the responses of 18 educators, 9 women and 9 men, who have spent an average of 19 years working as educators. Nine of the respondents were classroom teachers, four were district technology supervisors/coordinators, three were technology specialists at the classroom or school level, and two were librarians/media specialists. Although we aimed to represent all regions of the country in our sample, in the end we did not have any representatives from California or the Pacific Northwest, but other regions of the country were well represented. The breakdown was as follows: five from the Midwest, four from the Northeast, four from the South, and two each from the Mid Atlantic and Southwest states.

The Research Design

All but two of the eighteen interviews were conducted over the Internet. The remaining two were conducted over the phone. After an initial contact, participants were sent a open-ended questionnaire that covered the following topics:

- Internet Use : How long have you been using the Internet? For professional or for student use? What resources, what tools do you use?
- Involvement: How are you connected? How did you get started? Are you in a collaborative relationship with another institution?
- Learning: How did you learn? What were the obstacles? What was your original vision and how did it change? What was your previous experience with technology?)
- Use in schools: How does the Internet fit into your school day? Who else in your school uses it? Do you act as a resource person for other users? How is access paid for? Is your administration supportive?)
- Future: What would you do to improve the Internet for educators?
- Your background: How long have you been teaching? What is your primary job now?

Analysis

After reading through all of the replies it became clear that the respondents were offering a range of interpretations of their experience with the Internet in response to the question: "How did your initial vision or understanding of the Internet mesh with the realities of Internet use? Is your vision supported, modified, or drastically revised?" Based on their replies, we were able to group respondents according to their statements about the potential benefits and difficulties of using the Internet as a K-12 resource. We then investigated whether these differences appeared to be related to the following set of contextual variables: number of years working as an educator; number of years using computers for instructional purposes; number of years using the Internet; institutional support; collegial atmosphere; and type and amount of training about the Internet. Based on this analysis respondents fell into one of four groups.

Findings

Enthusiastic Beginners

> *I didn't have a clue as to what the Internet was before I had my introduction... I would hate to give it up now!*
>
> *I did think that I would be able to use it in the classroom, but I didn't realize how much. I didn't realize how much the Internet can be utilized in a first grade room!*
>
> *I have just experimented with the talk and chat modes and have to say that way of 'talking' produced a very strange (even profound) feeling in me.*

The *Enthusiastic Beginners* category represents the smallest group in this study, made up of two female classroom teachers who have been working as educators for an average of fifteen years. One is a first grade teacher, the other a teacher of high school English. Compared to the other educators in this study, they have considerably less experience using technology in their classrooms for instructional purposes (less than five years). They have been drawn into using the Internet through a specific project or training program and are receiving on-going, substantive support as they learn to use this resource. They have been using the Internet for less than a year, and are in the early phases of understanding and using the range of available resources. In spite of their novice status, they are extremely excited by their limited involvement with this environment. For example, the opportunity to exchange e-mail messages via the Internet, although hardly scratching the surface of the system, has intrigued these teachers and made them eager to learn more.

They are aware that they know little about the workings of the Internet as a whole, and are grateful to the trainers working with them. In addition to experts who are training them in using the Internet, they are working in

small teams with colleagues who are also novices, with whom they share ideas, advice, and resources. Their schools, which are either affluent or specialized science or technology schools, are investing in hardware, release time, and training, which all work to support the teachers their efforts. In general there appears to be an atmosphere of collegiality among teachers and administrators which surrounds the use of this technology. Although these educators are technology novices, they are working in conditions that allow them to find the process of learning exciting, rather than insurmountable or frustrating.

These two teachers describe the Internet as an exciting new resource, and imagine endless possibilities for applying it to classroom work. They recognize the central role their training is playing in their experience, and feel that training will be the most important factor in making the Internet accessible for other educators, including guided, structured training and demonstrations of real applications.

Evolving Understanding

> *We want to work with other schools but have not made solid connections through Internet yet.*
>
> *I did not think it was this complex. I thought it would be a lot more manageable.*
>
> *All I wanted was a way to reach other people on other networks and access the resources that I heard about...*
>
> *Time seems to be the biggest obstacle - time to explore. Right now I'm 'wrestling'...*

A third of the teachers in this study are in the middle of a difficult learning process -- they are struggling simultaneously with technical and conceptual obstacles as they try to explore the Internet, often on their own.

Two teachers in this group, one male and one female, teach traditional disciplines in the classroom; both are science teachers. The other four include two technology teachers, one male and one female, a district coordinator (female), and a librarian (female). They have been working for an average of twenty-one years as educators.

These teachers average eight years of experience using technology for instructional purposes, and have been using the Internet for between one and two years. This eight year average, which places them far above average technology use among teachers, strongly suggests that these teachers are comfortable and competent users of educational technology (Becker, in press; Sheingold & Hadley; Honey & Henriquez, 1993).

Four of these six educators are the only Internet users in their schools, and inform other teachers of resources and activities they discover via the Internet. They all describe themselves as self-taught. They have minimal support from their schools (i.e. paying for one phone line), but feel they are essentially on their own in their efforts.

Specific projects, or specific goals (e.g., accessing TERC's Global Lab bulletin board on EcoNet, particular penpal exchange projects), were central in motivating these educators to get on the Internet. They rarely articulated a general desire to explore the Internet, or a self-motivating fascination with the technology. After a year or two of mastering the skills needed for a particular task, or while still in the midst of discovering them, these teachers are finding themselves essentially alone with a resource which they do not fully understand, and they are working in environments that offer little support for further exploration.

Consistent with their own current frustration and determination, these educators consider a range of issues to all be crucial to making the Internet a

viable resource for educators. These include keeping costs low, offering training, developing educational content, increasing phone line access, and making the network easier to use.

These educators are in the midst of a difficult learning process. While they are preoccupied with technical obstacles, they are also struggling to form a coherent understanding of the makeup of the Internet. The have encountered, and they are hopeful that they will continue to find, useful resources on the net. However, they are consistently encountering a wide range of logistical and technical difficulties, and they lack resources in their local circumstances that would make it easier to overcome their current difficulties.

Cautiously Optimistic

> *...It has proven as difficult to learn as the streets of a large urban area. Many of the resources appear more useful than they turn out to be.*
>
> *The Internet is very unmanageable. I didn't know how to navigate through it. It is very unfriendly and I get kicked out without knowing why -- whether it was my fault or theirs... There are also not enough resources.*
>
> *If you don't have a high tolerance for frustration and a self-defined construct or image of how this all works, don't jump on the Internet.*

Another third of our respondents are cautious in their optimism about the value of the Internet as a K-12 resource. The six educators in this group have been working in education for an average of twenty-one years. They are very knowledgeable users of educational technology -- thirteen years of experience on average -- and all but one have been using the Internet for more than two years. Five are men, two of whom are classroom teachers

(high school English, middle school special education) , and three are district technology coordinators. The one woman in the group is a librarian.

As experienced and largely self-taught Internet users they are primarily concerned about the level of training and development that they feel will be necessary in order for the Internet to become both a viable and a useful resource for other K-12 educators. All but one of these educators describe themselves as leaders or mentors for other teachers who are beginning to use the Internet. They are the primary users in their schools and districts, and feel that it is important to share their expertise with others who are beginning to explore. Not only are they sharing technical expertise, but are frequently ferreting out resources for colleagues in their schools.

These experienced educators stressed two interrelated issues in their discussion of their experience with the Internet. They are very concerned with training issues. Through their own learning experiences, and in their current roles as trainers to their colleagues, they have experienced the frustrations and the rewards of Internet exploration. They articulated most strongly the need for coordinated training and support efforts for teachers exploring this new resource.

The cautiously optimistic users reported and demonstrated a high degree of familiarity with the range of resources that are available on-line, and expressed their disappointment with the quality and usefulness of those resources for the K-12 community. These educators have examined resources such as databases, reference materials, and discussion groups and often found them less substantive than they had hoped for, or often simply not appropriate to their needs as educators. Having explored a wide range of Internet resources, the cautiously optimistic group is now quite vocal about the need for more and better K-12 content. They also stress the importance of

consistent and convenient access for classroom teachers.

Experienced Enthusiasts

> I have been using the Internet since 1986...I was captivated, and began my explorations...
>
> My vision has drastically grown from the idea of a resource to the idea of virtual schools...
>
> I like to be on the cutting edge and see the vision of the Internet expanding and being used even more. It is a mechanism in search of applications.

The four *Experienced Enthusiasts* in our sample are teachers who have brought a high level of technology-related knowledge into their teaching. They average fourteen years of working as educators and more than eleven years of experience with educational technology. What distinguishes this group from the others is their highly technical backgrounds and/or advanced degrees in technological fields. They are individuals who came to education from other professions such as computational science and engineering. They are also distinguished from the other groups by their long-term involvement with the Internet -- averaging more than four years of experience.

There are two women and two men in this group. The two women are technology specialists, and the men are a science specialist and a social studies teacher. They are all in specialized or affluent schools which have resources to invest in technology use.

Each of these educators is unique in their school in their level of use of the Internet. They are all invested in training other educators in their school, district, or region. While some of this training work is supported by their schools, some of it is done independently and on the educators' own time.

All of these educators describe themselves as self-taught Internet users.

The experienced enthusiasts feel that providing adequate access to the Internet is crucial to K-12 education. As one educator from this group states, "Put a computer on every teacher's desk with Internet access." Another teacher proposes, "Give every teacher a computer and modem at home." Their concern for flexible and continuous Internet access is more prominent than the emphasis the Cautiously Optimistic group places on the training needs of their colleagues. Their highly technical backgrounds have most likely made the Internet a more transparent resource than it appears to be to less technologically-savvy teachers, and make it possible for them to enthusiastically embrace the Internet as a rich resource.

Discussion

The Internet offers a way to gain access to people, services, and resources that could potentially transform the workings of teachers' professional lives. The possibilities for connection and communication that the Internet affords can significantly change the way teachers think about their own and their students' relationships to the rest of the K-12 community, and to the world at large. However, as the voices we have represented in this paper make clear, the obstacles to making the Internet accessible, viable, and meaningful for K-12 education sometimes seem as vast as the current ocean of Internet activity.

Increasing numbers of educators are already making use of the Internet -- sharing ideas with colleagues all over the world, collecting data from faraway places and investigating elaborate libraries with their students, and conversing with their friends, their relatives, and often with complete strangers. But who are these teachers? Our small sample suggests that they

are extremely technologically sophisticated, that they draw on skills and expertise that they developed outside of their professional role as teachers, and that they are working in schools which provide, at a minimum, an adequate level of access to hardware and release time - and often provide a great deal more. Clearly, few teachers come close to matching this description; even among the teachers represented in this sample only the experienced enthusiasts are likely to be carrying out all of the activities described above with consistent success.

While there are distinct differences among the educators represented in this study, it is important to recognize that even those described as novices here would be classified as highly technologically sophisticated when compared to the nation's teachers as a whole. Becker's (in press) research on teachers who are accomplished users of technology in the classroom, has found that these individuals represent approximately 5% of the country's teaching population. We estimate that it is a small minority (approximately 2% of this 5%) of these accomplished teachers who are actively using the Internet. So what needs to be done to make the Internet a more friendly environment that can accommodate swimmers and drivers, as well as those just learning to walk? A number of issues - some conceptual, some concrete, all interrelated - need to be addressed.

Multiple metaphors

For an isolated, novice Internet user, with no expert colleague available for help and guidance, plugging away on a 1200 baud modem in the back of the school library during lunch period, the Internet is no information highway. It is complicated, it is arcane, it is obstinate. And for a knowledgeable district technology coordinator trying to find useful resources for an enthusiastic foreign language teacher, the Internet may not seem like

much of an ocean - rather than rich in resources, it may seem paltry and insubstantial; rather than endless, uncharted, and fascinating, it may seem arid and dull.

The experts, the developers and the researchers who help to bring the Internet into schools need to be thoughtful about and receptive to the multiple, and probably diverse, metaphors that educators bring to the experience of learning to navigate this conceptually difficult technological space. They need to incorporate these metaphors into their work, and disseminate images of the Internet that encourage complex, rather than monolithic, descriptions of how this space may come together in the mind of any individual user. Additional research is this area could inform design work, facilitate the development of training materials and programs, and continue to enrich and enliven the evolution of our conceptual understanding of the Internet and its communities.

Support and Training

Regardless of their level of experience, the teachers who were more positive about the usefulness and excitement of using the Internet in their teaching were teachers who were working with groups - who were engaged in an ongoing process that involved both extensive training from experts and consistent support from colleagues. Training opportunities for teachers need to be supported by administrators, who make the time available. There are many potential avenues to creating training opportunities -- on-line courses, such as those developed by Montana's Big Sky Telegraph, front ends that control what resources available to a user and open up the system gradually as the user becomes more knowledgeable, such as Texas's TENET; graphical interfaces that bridge the gap between users and resources, such as the GUIDE developed by the California Technology Project, university or research

institution partnerships, such as TERC's Global Lab Project; in-school specialists; and collaborations between technology specialists and librarians/media specialists.

Administrative and Pedagogical Flexibility

Every educational innovation introduces new strains on teachers' schedules. Gaining an understanding of the Internet may, in the long run, make some tasks easier and quicker for teachers, but learning to use the network requires an intensive investment of time. Few teachers have adequate time in their schedule for meaningful, substantive Internet training. Some of our respondents felt strongly that home access was the answer to this problem -- that giving educators access to the Internet on their own time, in their own home, provides an opportunity to explore, make mistakes and discover new tools that could not be duplicated in the school. However, this cannot be an adequate solution on its own, and school administrators need to commit to supporting their teachers in learning such a significant new skill, whether through summer workshops, in-service training, or pre-service programs.

In addition, many educators in this study stressed the value of their working relationships with colleagues. In order for teachers to experiment with new roles that telecommunications can play in their classrooms, flexible structures such as team teaching, interdisciplinary work, and shared planning time must be made possible.

Better resources for K-12 community

The Internet was not designed with the K-12 community in mind. Neither were the vast majority of resources currently available on-line. Too often, enthusiasm over the potential the *infrastructure* of the Internet offers for changing relations between K-12 professionals, students, and institutions

and the rest of the world is equated with enthusiasm for the resources currently available on the net. Even if educators gained total access to the Internet tomorrow, a great deal of work needs to be done to provide adequate answers to the inevitable question, "What can I, a classroom teacher, do with this?" While it is clear that there is a need for better navigation and search tools, and for improved directors and pointers to K-12 resources, it is clear that there is a great need for well designed, substantial, and relevant K-12 resources in a range of content areas. Such resources can range from student produced historical archives, like the Armadillo gopher in Texas, to inservice professional development courses such as the Mathematics Learning Forums Project at Bank Street College.

Access

When these educators mentioned the need for greater access, which they did frequently, they most often meant some combination of four things:

Phone lines In some cases, our respondents were struggling just to get one phone line in their classroom. Others had discovered that they needed multiple separate lines in the building so that more than one telecommunications activity could go on simultaneously. Teachers are the only group of professionals who do not have regular access to telephones, often because the cost of installing phone lines in school buildings is prohibitive. The cost of installing phone lines in schools is often prohibitive because schools are charged business installation rates. There need to be federal incentives that encourage the private sector to support the K-12 communities in gaining access to the Internet.

Accounts Some teachers are locked into specific providers, which may or may not be the systems they would like to use. Others are paying out of their own pockets for their accounts, and need district support with registration and on-line fees. Others find themselves having to cajole less-than-sympathetic universities to provide them with basic access. While such arrangements speak to the dedication of the teachers involved, in the long run dial-up connections via low-baud modems to distant nodes may be at best a complex and at worst an unreliable means of connecting to the Internet. Implementing in-school local-area networks connected to wide-area networks outside of the school is a design which is currently being promoted at BBN Laboratories, among others, and which offers great promise (Newman, Bernstein & Reese, 1992; Newman, Reese & Huggins, 1993). Securing this kind of reliable and direct connection to the Internet is crucial if we expect teachers to make substantive use of the net and be active contributors to the growing body of K-12 content.

Hardware A number of these educators have computers in their classrooms, but many are communicating from libraries, department offices, or their own homes. Few if any schools have enough machines to involve more than a few students in telecommunications activities at once. Using the Internet does not require a powerful computer (although having at least one high speed modem available for large FTP files, etc., is helpful) -- but if students are to become meaningfully involved in activities using the Internet, multiple computers in teachers' classrooms are necessary.

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